

This Page Is Inserted by IFW Operations
and is not a part of the Official Record

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

**As rescanning documents *will not* correct images,
please do not report the images to the
Image Problem Mailbox.**

WHAT IS CLAIMED IS:

1. A manufacturing method of an alkaline solution, comprising: dissolving a gaseous molecule having oxidizing properties or reducing properties in
5 an aqueous alkaline solution.

2. The manufacturing method of the alkaline solution according to claim 1, further comprising: dissolving at least one of oxygen, ozone, carbon monoxide, and hydrogen peroxide as the gaseous molecule
10 having said oxidizing properties in said aqueous alkaline solution.

3. The manufacturing method of the alkaline solution according to claim 1, further comprising: dissolving at least one of hydrogen, H_2S , HNO_3 , and
15 H_2SO_3 as the gaseous molecule having said reducing properties in said aqueous alkaline solution.

4. The manufacturing method of the alkaline solution according to claim 1, wherein an alkali concentration of said alkaline solution is not less
20 than 1% and less than 4%.

5. A manufacturing method of an alkaline solution, comprising: mixing a solution in which a gaseous molecule having oxidizing properties or reducing properties is dissolved in pure water with an
25 aqueous alkaline solution.

6. The manufacturing method of the alkaline solution according to claim 5, further comprising:

dissolving at least one of oxygen, ozone, carbon monoxide, and hydrogen peroxide as the gaseous molecule having said oxidizing properties in said pure water.

5 7. The manufacturing method of the alkaline solution according to claim 5, further comprising: dissolving at least one of hydrogen, H_2S , HNO_3 , and H_2SO_3 as the gaseous molecule having said reducing properties in said pure water.

10 8. The manufacturing method of the alkaline solution according to claim 5, wherein an alkali concentration of said alkaline solution is not less than 1% and not more than a saturated concentration.

15 9. An alkaline solution which is manufactured using the manufacturing method of the alkaline solution according to claim 1 or 5.

20 10. A pattern forming method comprising:
 coating a substrate with a photosensitive resist film;
 exposing said photosensitive resist film;
 supplying a developing solution in which a gaseous molecule having oxidizing properties or reducing properties is dissolved to said photosensitive resist film, and developing the resist film; and
 supplying a cleaning solution to the surface of
25 said substrate, and cleaning the substrate.

11. The pattern forming method according to claim 10, further comprising: discharging the

developing solution to said photosensitive resist film
from a developing solution supply nozzle; relatively
moving said substrate and said developing solution
supply nozzle; forming a developing solution film on
5 the surface of the resist film; and developing said
photosensitive resist film.

12. The pattern forming method according to
claim 11, further comprising: fluidizing the developing
solution film on said photosensitive resist film after
10 said developing solution film is formed.

13. The pattern forming method according to
claim 10, further comprising: supplying an oxidizing
solution or a reducing solution as said cleaning
solution to said substrate surface.

14. A removing method of a resist film,
15 comprising:

supplying an alkaline removing solution with a
gaseous molecule having oxidizing properties or
reducing properties dissolved therein onto a substrate
20 in which a pattern of a photosensitive resist film
formed on a surface is used as a mask to perform an
etching treatment, and removing the resist film; and

supplying a cleaning solution onto said substrate,
and cleaning the substrate.

25 15. A solution application apparatus comprising:
a substrate holding base which holds a substrate;
a gas dissolution mechanism including either one

of a mechanism in which an oxidizing gas is dissolved in an alkaline solution and a mechanism in which a reducing gas is dissolved in the alkaline solution;

an alkaline solution supply nozzle which supplies
5 the alkaline solution in which a gaseous molecule having oxidizing properties or reducing properties is dissolved by the gas dissolution mechanism onto the substrate ; and

a cleaning solution supply nozzle which supplies a
10 cleaning solution onto said substrate.

16. A substrate treatment method comprising:

coating a substrate with a photosensitive resist
film;

exposing said photosensitive resist film;

15 supplying a reducing solution the surface of said exposed photosensitive resist film and performing a pretreatment;

developing the photosensitive resist film
subjected to said pretreatment; and

20 supplying a cleaning solution to said substrate, and cleaning the substrate.

17. The substrate treatment method according to claim 16, wherein the reducing solution is an aqueous solution containing at least one of hydrogen, H_2S ,
25 HNO_3 , and H_2SO_3 .

18. The substrate treatment method according to claim 16, further comprising: discharging the

developing solution to said photosensitive resist film
from a developing solution supply nozzle; relatively
moving said substrate and said developing solution
supply nozzle; forming a developing solution film on
5 the surface of the photosensitive resist film; and
developing said photosensitive resist film.

19. The substrate treatment method according to
claim 18, further comprising: agitating said developing
solution film; and developing said photosensitive
10 resist film.

20. The substrate treatment method according to
claim 16, further comprising: removing said reducing
solution from the surface of said photosensitive resist
film after said pretreatment; drying the surface of the
15 resist film; and developing said photosensitive resist
film.

21. The substrate treatment method according to
claim 18, further comprising: forming said developing
solution film on the resist film surface in a state in
20 which said reducing solution remains on the surface of
said photosensitive resist film after said
pretreatment; agitating the remaining solution and the
developing solution; and developing said photosensitive
resist film.

25 22. A substrate treatment method comprising:
coating a substrate with a photosensitive resist
film;

exposing said photosensitive resist film;
supplying a developing solution to said
photosensitive resist film, and forming a developing
solution film;

5 supplying a functional solution having oxidizing
properties or reducing properties onto the substrate
with said developing solution film formed thereon, and
subsequently fluidizing the functional solution and
said developing solution film; and

10 supplying a cleaning solution to the surface of
said substrate, and cleaning the substrate.

23. The substrate treatment method according to
claim 22, further comprising: supplying the cleaning
solution having the oxidizing properties or the
15 reducing properties as said cleaning solution to said
substrate surface.

24. The substrate treatment method according to
claim 22, further comprising: using an aqueous solution
containing at least one of ozone, oxygen, carbon
20 monoxide, and hydrogen peroxide as the functional
solution having said oxidizing properties.

25. The substrate treatment method according to
claim 22, further comprising: using an aqueous solution
containing at least one of hydrogen, H_2S , HNO_3 , and
25 H_2SO_3 as the functional solution having said reducing
properties.

26. The substrate treatment method according to

claim 22, further comprising:

discharging the developing solution to said
photosensitive resist film from a developing solution
supply nozzle;

5 relatively moving said substrate and said
developing solution supply nozzle; and

forming said developing solution film on the
surface of said photosensitive resist film.

27. The substrate treatment method according to
10 claim 22, further comprising:

discharging said functional solution to said
photosensitive resist film from a functional solution
supply nozzle;

15 relatively moving said substrate and said
functional solution supply nozzle; and

forming a functional solution film on the surface
of said photosensitive resist film.

28. A solution supplying method of scanning a
linear solution supply nozzle from one end to the other
20 end of a substrate, and supplying a solution onto the
substrate via the solution supply nozzle to form a
solution film on the substrate, said method comprising:

controlling at least one of a supply amount of a
solution from the solution supply nozzle and a scanning
25 speed of said solution supply nozzle so that a film
thickness d of the solution film formed on said
substrate is equal to a gap H between said solution

supply nozzle and the substrate.

29. A solution supplying method of scanning a linear solution supply nozzle from one end to the other end of a substrate, and supplying a solution onto the substrate via the solution supply nozzle to form a solution film on the substrate, said method comprising:

5 setting a gap H (mm) between said solution supply nozzle and the substrate to a value obtained by dividing a solution supply speed Q ($\mu\text{l}/\text{sec}$) from said solution supply nozzle by a product of a scanning speed V (mm/sec) of said solution supply nozzle and a length L (mm) of a discharge port of said solution supply nozzle.

30. A solution supplying method of scanning a linear solution supply nozzle from one end to the other end of a substrate, and supplying a solution onto the substrate via the solution supply nozzle to form a solution film on the substrate, said method comprising:

15 setting a solution supply speed Q ($\mu\text{l}/\text{sec}$) to a product of a gap H (mm) between said solution supply nozzle and the substrate, a scanning speed V (mm/sec) of said solution supply nozzle, and a length L (mm) of a discharge port of said solution supply nozzle.

31. The solution supplying method according to claim 30, further comprising: increasing said solution supply speed Q ($\mu\text{l}/\text{sec}$) with the scanning of said solution supply nozzle, when a change of a length l of

the substrate of a portion with said solution supplied thereto tends to increase; and lowering said solution supply speed Q ($\mu\text{l}/\text{sec}$) with the scanning of said solution supply nozzle, when the change of said length l tends to decrease.

32. The solution supplying method according to claim 31, further comprising: controlling the solution supply speed Q ($\mu\text{l}/\text{sec}$) in a position x (mm) of said solution supply nozzle the center of a substrate to a value corresponding to a product of a solution supply speed Q_0 ($\mu\text{l}/\text{sec}$) of a time at which said solution supply nozzle is positioned in the substrate middle, and a change amount (dl/l) of a length l (mm) of the substrate of a portion with said solution supplied thereto of a time at which said solution supply nozzle moves on the substrate by a unit distance (dx).

33. A solution supplying method of scanning a linear solution supply nozzle from one end to the other end of a substrate and forming a solution film on the substrate, said method comprising:

setting a scanning speed V (mm/sec) of said solution supply nozzle to a value corresponding to a value obtained by dividing a solution supply speed Q ($\mu\text{l}/\text{sec}$) from said solution supply nozzle by a product of a gap H (mm) between a supply position of said solution supply nozzle and the substrate and a length L (mm) of a discharge port of said solution

supply nozzle.

34. The solution supplying method according to claim 33, further comprising: lowering said scanning speed with the scanning of said solution supply nozzle when a change of a length l of the substrate of a portion with said solution supplied thereto tends to increase, and increasing said scanning speed with the scanning of said solution supply nozzle, when the change of said length l tends to decrease.

35. The solution supplying method according to claim 34, further comprising: correcting the nozzle scanning speed V (mm/sec) in a position x (mm) of said solution supply nozzle from a substrate middle in accordance with a value of a product of a scanning speed V_0 (mm/sec) of a time at which said solution supply nozzle is positioned in the center of a substrate, and a change amount (dl/l) of a length l (mm) of the substrate of a portion with said solution supplied thereto of a time at which said solution supply nozzle moves on said substrate by a unit distance (dx) .

36. A manufacturing method of a semiconductor device, comprising:

coating a substrate with a photosensitive resist film;
exposing said photosensitive resist film;
supplying a developing solution with a gaseous

molecule having oxidizing properties or reducing
properties dissolved therein to said photosensitive
resist film, and developing the resist film; and
supplying a cleaning solution to the surface of
5 said substrate, and cleaning the substrate.

37. A manufacturing method of a semiconductor
device, comprising:

supplying an alkaline removing solution with a
gaseous molecule having oxidizing properties or
10 reducing properties dissolved therein onto a substrate
in which a pattern of a photosensitive resist film
formed on a surface is used as a mask to perform an
etching treatment, and removing the resist film; and
supplying a cleaning solution onto said substrate,
15 and cleaning the substrate.

38. A manufacturing method of a semiconductor
device, comprising:

coating a substrate with a photosensitive resist
film;
20 exposing said photosensitive resist film;
supplying a reducing solution the surface of said
exposed photosensitive resist film and performing a
pretreatment;
developing the photosensitive resist film
25 subjected to said pretreatment; and
supplying a cleaning solution onto said substrate,
and cleaning the substrate.

39. A manufacturing method of a semiconductor device, comprising:

coating a substrate with a photosensitive resist film;

5 exposing said photosensitive resist film;

supplying a developing solution to said photosensitive resist film, and forming a developing solution film;

10 supplying a functional solution having oxidizing properties or reducing properties onto the substrate with said solution film formed thereon, and subsequently fluidizing the functional solution and said developing solution film; and

15 supplying a cleaning solution to the surface of said substrate, and cleaning the substrate.

40. A manufacturing method of a semiconductor device of scanning a linear solution supply nozzle from one end to the other end of a substrate, and supplying a solution onto the substrate via the solution supply
20 nozzle to form a solution film on the substrate, said method comprising:

controlling at least one of a supply amount of a solution from the solution supply nozzle and a scanning speed of said solution supply nozzle so that a film
25 thickness d of the solution film formed on said substrate is equal to a gap H between said solution supply nozzle and the substrate.

41. A manufacturing method of a semiconductor device of scanning a linear solution supply nozzle from one end to the other end of a substrate, and supplying a solution onto the substrate via the solution supply nozzle to form a solution film on the substrate, said
5 method comprising:

setting a gap H (mm) between said solution supply nozzle and the substrate to a value obtained by dividing a solution supply speed Q ($\mu\text{l}/\text{sec}$) from said
10 solution supply nozzle by a product of a scanning speed V (mm/sec) of said solution supply nozzle and a length L (mm) of a discharge port of said solution supply nozzle.

42. A manufacturing method of a semiconductor device of scanning a linear solution supply nozzle from one end to the other end of a substrate, and supplying a solution onto the substrate via the solution supply nozzle to form a solution film on the substrate, said
15 method comprising:

20 setting a solution supply speed Q ($\mu\text{l}/\text{sec}$) to a product of a gap H (mm) between said solution supply nozzle and the substrate, a scanning speed V (mm/sec) of said solution supply nozzle, and a length L (mm) of a discharge port of said solution supply nozzle.

25 43. A manufacturing method of a semiconductor device of scanning a linear solution supply nozzle from one end to the other end of a substrate, and supplying

a solution onto the substrate from the solution supply nozzle to form a solution film on the substrate, said method comprising:

5 setting a scanning speed V (mm/sec) of said
solution supply nozzle to a value corresponding to a
value obtained by dividing a solution supply speed
 Q ($\mu\text{l/sec}$) from said solution supply nozzle by a
product of a gap H (mm) between a supply position of
said solution supply nozzle and the substrate and a
10 length L (mm) of a discharge port of said solution
supply nozzle.